REMARKS

Claims 16 and 20 are amended. Claims 7, 17, 46, 56 and 62 are canceled. Claims 8-10, 14-16, 19-21, 47-55, 57-61, 63 and 64 are in the application for consideration.

Independent claims 16 and 20 have been amended to recite that the etching chemistry consists essentially of reactive components of ammonia and at least one fluorocarbon, and that the etching chemistry comprises a volumetric ratio of all fluorocarbon to ammonia from 40:1 to 20:1. These limitations in combination with the other limitations of claims 16 and 20, respectively, are not anticipated or obvious over any of the references of record as argued below.

At the outset, the undersigned notes that the Examiner has stated with respect to selectivity toward photoresist that such "can be altered by adjusting the fluorine-to-carbon ratio with hydrogen additions and altering the etch chemistry to make the etchant more selective toward the photoresist." For such proposition, the Examiner cites to Wolf. The undersigned has reviewed p. 40+ of Wolf Vol. 2, pp. 555+ of Wolf Vol. 1, and pp. 52+ of Wolf Vol. 1 and 2 and finds no such support for the Examiner's above statement. If the Examiner is to persist in this allegation, it is respectfully requested that the Examiner specifically point to the very language which supports this conclusion.

The Examiner also provides,

> Ding (column 5 lines 45-550 [*sic*]) teaches that the etching chemistry comprises fluorocarbon gasses, NH3 generating gas (ammonia), a carbon-oxygen gas, and an optional inert gas, thus teaching a chemistry which is essentially fluorocarbon gasses and ammonia. Further, (column 9 lines 17-18) Ding teaches that the flow rate of carbon-oxygen is lower than that of the fluorocarbon, thus the combination of fluorocarbon and ammonia is greater than 50% of the mix, hence essentially fluorocarbon gasses and ammonia. [*emphasis added.*]

The Examiner is in error with regard to the conclusions drawn from the subject cited language.

Specifically, at col. 5, lns. 47-57, Ding et al. clearly and only disclosed that the processing gas includes i, ii, iii, iv components. However as is clearly disclosed and evident, it is only component iv which is stated to be optional (col.5, ln.55). Accordingly, clearly the other components are not optional but are required or Ding et al. would have stated that such were optional. Regarding col.9, lns.17-22, such is merely stating that the volumetric flow ratio of the carbon-oxygen gas is not greater than the flow rate of the fluorocarbon gas to provide sufficient fluorine-containing species to rapidly etch the substrate. Clearly, such statement/disclosure is not to use absolutely no carbon-oxygen gas, as it is everywhere disclosed within Ding et al., (including at col.9, lns.17-22) that a carbon-oxygen component is a necessary component of the Ding et al. etching chemistry, and thus participates as a reactive component in effecting the etch. Accordingly, contrary to the Examiner's assertion, the very sections cited by the Examiner clearly do not disclose and do not suggest using an etching chemistry in the etch of silicon nitride which consists essentially of reactive components of

ammonia and at least one fluorocarbon. Rather, what the reference teaches is that a carbon-oxygen component is a necessary part of the etching chemistry. In this manner, the reference teaches away from that which Applicant recites in its claims.

Further, independent claims 16 and 20 are amended to recite that the etching chemistry comprises a volumetric ration of all fluorocarbon to ammonia from 40:1 to 20:1. Clearly, the only meaningful teaching to be drawn from Ding et al. is to NOT utilize a ratio above 2.5:1 (col.7, lns.11-13) in spite of Fig. 3 showing experiments were tried at no greater than between 10:1 and 11:1 flow ratios of fluorocarbon to ammonia. Under no conceivable stretch of the imagination does Ding et al. disclose or suggest using a ratio of from 40:1 to 20:1, and in fact teaches against doing so.

The Examiner is reminded that the prior art must be considered in its entirety, including disclosures that teach away from the claims. M.P.E.P. §2141.02. Clearly in its entirety, Ding et al. teaches away from an etching chemistry consisting essentially of reactive components of ammonia and at least one fluorocarbon, and a ratio from 20:1 to 40:1, as Applicant recites in each of its independent claims 16 and 20.

Further, any proposed modification to an Applicant's claims cannot render the prior art unsatisfactory for its intended purposes M.P.E.P. §2143.01. Accordingly, any assertion or suggestion by the Examiner of modifying Ding et al. in accordance with Applicant's independent claims 16 and 20 would inherently

render such prior art unsatisfactory for its disclosed/intended purposes of increasing, not decreasing, the etch rate of silicon dioxide (col.7, lns.11-13).

For at least the foregoing reasons, amended claims 16 and 20 are allowable.

Further regarding claim 20, such additionally includes the limitation of the etching chemistry comprising ammonia and at least one of C_4F_6 and C_5F_8 in etching silicon nitride substantially selectively relative to a photoresist comprising material where increased selectivity is provided than would otherwise occur in the absence of ammonia. However, the English Abstract of the '071 Japanese reference clearly teaches etching of both photoresist and silicon nitride using a chemistry involving a CF compound. Therefore, etching selectivity and the other methodical aspects of Applicant's claim 20 are not taught by this reference, and in fact, the opposite of the claim selectivity recited in claim 20 is taught. Accordingly, the JP '071 reference specifically teaches against its combination with the '563 Ding et al. patent, which does teach not etching photoresist, and rather a selective etching process relative thereto. Thus, the Japanese reference inherently teaches against the very combination which the Examiner makes, and away from Applicant's independent claim 20 for this additional reason. Further, with the Japanese reference constituting a prior art teaching, it teaches away from the subject matter of Applicant's independent claim 20 even were the Examiner to reject such claim under a combination of references of record not involving the Japanese reference. Claim 20 should be allowed for these additional reasons to those argued above.

For the foregoing respective reasons, Applicant's independent claims 16 and 20 should be allowed and action to that end is requested.

Each of Applicant's dependent claims presented herein should be allowed as depending from allowable base claims, and for their own recited features which are neither shown nor suggested in the cited art. Action to that end is requested.

This application is believed to be in immediate condition for allowance.

Respectfully submitted,

Dated: 11-20-02 By: _____

Mark S. Matkin
Reg. No. 32,268

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application Serial No. 09/920,978
Filing Date ..... August 1, 2001
Inventor ..... Shane J. Trapp
Assignee ..... Micron Technology, Inc.
Group Art Unit ..... September 25, 2002
Examiner ..... David Blum
Attorney's Docket No. MI22-1674
Title: Method of Forming Integrated Circuitry and Method of Forming Shallow Trench Isolation in a Semiconductor Substrate

VERSION WITH MARKINGS TO SHOW CHANGES MADE ACCOMPANYING RESPONSE TO DATE OFFICE ACTION

In the Claims

The claims have been amended as follows. Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

Cancel claim 7.

16. (Thrice Amended) A method of forming integrated circuitry comprising:

forming a layer comprising silicon nitride over a semiconductor substrate;

forming a patterned photoresist comprising masking layer over the silicon nitride layer, the patterned masking layer comprising mask openings therethrough; and

etching the silicon nitride comprising layer through the mask openings substantially selectively to the photoresist comprising layer using an etching chemistry ~~comprising~~ consisting essentially of reactive components of ammonia and at least one fluorocarbon under etching conditions effective to substantially

anisotropically etch the silicon nitride comprising layer, the etching chemistry comprising a volumetric ratio of all fluorocarbon to the ammonia of from 40:1 to ~~9:1~~ 20:1 and providing increased selectivity to the photoresist comprising masking layer than would otherwise occur using identical etching chemistry and identical etching conditions without any ammonia.

Cancel claim 17.

20. (Thrice Amended) A method of forming integrated circuitry comprising:

forming a layer comprising silicon nitride over a semiconductor substrate;

forming a patterned photoresist comprising masking layer over the silicon nitride layer, the patterned masking layer comprising mask openings therethrough; and

etching the silicon nitride comprising layer through the mask openings substantially selectively to the photoresist comprising layer using an etching chemistry ~~comprising~~ consisting essentially of reactive components of ammonia and at least one fluorocarbon under etching conditions effective to substantially anisotropically etch the silicon nitride comprising layer, the etching chemistry comprising a volumetric ratio of all fluorocarbon to the ammonia of from 40:1 to ~~3:1~~ 20:1 and providing increased selectivity to the photoresist comprising masking layer than would otherwise occur using identical etching chemistry and identical etching conditions without any ammonia, wherein the fluorocarbon is at least one member selected from the group consisting of C_4F_6 and C_5F_8.

Cancel claims 46, 56 and 62.

-END OF DOCUMENT-